

Pluto Express: Advanced Technologies Enable Lower Cost Missions to the Outer Solar System and Beyond

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Abstract

Missions to Pluto and the outer Solar System are typically driven by factors which tend to increase cost, such as: long life, high radiation exposure, a large power source, high AV requirements, difficult telecommunications links, low solar illumination at the destination, and demanding science measurements. Advanced technology is a central part of responding to such challenges in a manner which permits the cost of development and operations to be an order of magnitude less than for prior outer planet missions. Managing the process of technology planning and advanced development versus the associated cost and mission risk is a formidable challenge. Outer Solar System/Pluto/Europa development activities are leveraging the latest products from the industry, government lab and academia technology pipeline in the areas of software, low power integrated microelectronics, low mass, high efficiency radioisotope power, and telecommunications.

This paper summarizes the current technology development plan, which is tightly coupled to the New Millennium Program (NMP) *Deep Space 1* technology validation flight. Specific detail will be presented about advanced microelectronics technology. This technology will also be shown in the context of an on-going technology roadmap that extends beyond the Pluto Express mission. Other details focus on new technologies available for low cost mission operations, and the processes required to best develop and utilize these technologies. The development goal is to create an integrated flight and ground system with the functional simplicity necessary to achieve high reliability, operability, and a low total mission cost. The development process leverages the JPL Flight System Testbed and commercial off-the-shelf (COTS) products. A university partnership provides additional development support and is leading to a partnership for operations. Software technologies for spacecraft self-commanding and self-monitoring play a key role in meeting an operations vision called Beacon Monitoring. This approach is expected to decrease operations cost significantly by reducing the amount of routine interaction with the spacecraft. The experience gathered may be valuable to Earth orbiting missions, the Mars Exploration Program, and Mission to Planet Earth.